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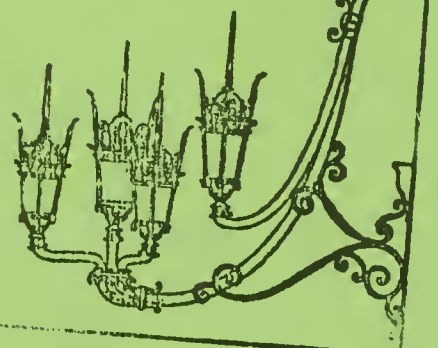
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PRELIMINARY APPLICATION  
OF  
BOSTON REDEVELOPMENT AUTHORITY  
FOR  
DEMONSTRATION ASSISTANCE TO  
CONSTRUCT THE  
SOUTH STATION INTERMODAL TRANSPORTATION TERMINAL  
BOSTON, MASSACHUSETTS

APRIL 1976

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1976



# Boston Redevelopment Authority

Robert T. Kenney / Director

City Hall  
1 City Hall Square  
Boston, Massachusetts 02201  
Telephone (617) 722-4300

APR 29 1976

Mr. Asaph H. Hall  
Deputy Administrator  
Federal Railroad Administration  
Department of Transportation  
400 7th Street, S.W.  
Washington, D.C. 20590

"BOSTON PUBLIC LIBRARY"

Re: Preliminary Application for Demonstration Assistance  
for the South Station Intermodal Transportation Terminal  
Boston, Massachusetts

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Dear Mr. Hall:

Enclosed please find an original and five (5) copies of the preliminary application for Demonstration Assistance for the South Station Intermodal Transportation Terminal in accordance with Section 15 of the Amtrak Improvement Act of 1974 and, more particularly, Section 256.5 and 256.9 of Title 49, Code of Federal Regulations.

As you are aware, we are proceeding on the basis of planning and preservation funding to develop a feasible plan for a South Station Intermodal Terminal. As the enclosed application outlines, our planning is on schedule; the demand analysis and schematic plans are complete and we are beginning to discuss our project with the various applicable funding agencies.

The proposed schedule of funding is indicated on table 3. We expect to apply to UMTA for commuter rail and bus improvements (\$13,345,331), FHWA for ramps and drums (\$15,600,000), Northeast Corridor for Inter-City rail operational and non operational improvements (24,670,079), and we are exploring the possibility of Federal funding of the necessary utility work from non Department of Transportation sources. The City's investment is currently projected at \$35,570,690.

We are presently applying to you, pursuant to the Intermodal legislation, for \$21,633,526 in order to renovate the headhouse (\$5,271,600) and construct an Inter-City bus terminal (\$16,361,926). Both of these items are eligible for funding under the Intermodal legislation whereas they do not appear to be eligible under the other funding sources.





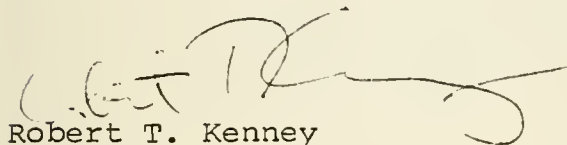
Mr. Asaph H. Hall

Page two

Given the eligibility requirements and funding limitations of other programs, however, it is quite possible that this request will be increased. As our negotiations proceed with the various Federal and State agencies, we will be in contact to review our needs.

We look forward to your continued cooperation in developing a South Station Intermodal Terminal.

Sincerely,

A handwritten signature in dark ink, appearing to read "Robert T. Kenney", with a long horizontal flourish extending to the right.

Robert T. Kenney  
Director



BOSTON REDEVELOPMENT AUTHORITY

PRELIMINARY APPLICATION FOR DEMONSTRATION FUNDS

256.9

- (1) Boston Redevelopment Authority  
City Hall  
One City Hall Square  
Boston, MA 02201
- (2) Robert T. Kenney, Director  
Boston Redevelopment Authority  
City Hall  
One City Hall Square  
Boston, MA 02201
- (3) Presently, South Station is used only as a train terminal serving about 3,800 daily train commuters and 700 daily intercity passengers in each direction. This terminal must now be upgraded in order to meet Federal Intercity Rail Standards and to provide for an increase in passenger volumes which is expected to triple by 1990. (See Table 1)

Bus facilities likewise need to be accommodated in a modern, centrally-located complex. At the present time, intercity bus service is carried out in two separate terminals. In both, passenger areas are crowded, bus operating and storage space is inadequate, and package express facilities limited. These problems will be exacerbated by the twofold increase in intercity bus patronage expected by 1990, from 3,700 to 8,500 passengers in each direction. (See Table 1, and Exhibit B)

Relocation and consolidation of the two intercity bus terminals have been the subject of discussion and planning for many years. Proposed at South Station is an intermodal terminal which will consolidate the previously described rail and bus service, as well as the commuter bus service into a single facility with subway access and direct access highway ramps connecting a garage and bus terminals to the Southeast Expressway. (Map 1)

The downtown location and the proximity of the subway will make the Transportation Center convenient for rail and bus commuters. The Transportation Center can be directly connected to the nearby Central Artery (Route I-93) and Turnpike (Route I-90) freeing buses from the congestion of city streets and providing convenient access for automobiles to pick up and drop off travelers. Similarly, replacement of current downtown parking with a facility having direct access to regional expressways will further reduce congestion on Boston's streets.

The elements of the proposed Intermodal Terminal are described in detail in Exhibit A and summarized below:

1. Railroad service: the envelope will be expanded to include 12 tracks with new high-level platforms over 1200 feet long and 24 feet wide, new switching, and new signal systems. The new concourse will include the elements listed in the performance standards for Corridorrail A level stations compiled by Northeast Corridor Office, FRA, under Task 12. Four tracks will be for intercity rail, 8 tracks for commuter rail.
2. Bus service: the intermodal center will include both intercity (61 bays) and commuter bus facilities (30 bays) with baggage, ticket, waiting rooms, and package express functions designed to meet the needs of the users. Exclusive bus lanes will connect from the Mass Pike and to the Southeast Expressway and Mass Pike. Short-term parking and drop-off areas will be available.
3. Parking: approximately 1,500 long-term garage spaces will be provided for commuters and users of the transportation facilities. An additional 529 spaces for short-term parking will accommodate the pick-up, drop-off, and package express functions. Access to the garage is located at Kneeland Street within one block from the Turnpike and Expressway exits, and at Essex Street serving local traffic.
4. Subway improvements: provisions will be made for direct access to the new terminal and modernization of the existing subway station.

The objectives to be achieved by development of the South Station terminal and in particular the intercity bus terminal and renovation of the headhouse are described below:

1. Consolidation of rail, intercity bus, and commuter bus facilities in one location and thus promoting interchange among the modes as well as allowing for more efficient sharing of common facilities.

2. Create a significant improvement in the operational characteristics of rail and buses by providing modern facilities for vehicular and passenger access and egress, ticketing, baggage handling and waiting space.
3. Allow for the complete rehabilitation of the historically significant South Station Headhouse for passenger services, exhibit space and offices.
4. Establish abbreviated intercity bus travel times on account of direct connections with major arterials, and reduced congestion and pollution of local streets.

As to means of accomplishment, the South Station Intermodal Terminal will be developed by a local/State, Federal partnership as shown on Table 3. At a minimum, four Federal agencies - FRA, FHWA, UMTA and EDA, would be participating in this project. The local contribution is currently projected at \$35,579,690.

- (4) The total cost of developing the South Station project is estimated at \$113,454,626. Pursuant to the definition of allowable project costs as set forth in Section 256.3(c) and 256.7(a)(2), (3), the entire project is eligible for financing under subsection 4(j) of the Act (See Table 3).
- (5) A total of \$21,633,526 is being requested in this preliminary application for demonstration funds in order to renovate the headhouse (\$5,271,600) and construct an intercity bus terminal (\$16,361,926). As indicated in the Unified Funding Program (Table 3), neither of these items is an eligible expense under the other major federal programs.
- (6) It is our intention to continue to pursue a Unified Work and Financing Program which will include but not be limited to the following Federal programs:
  - (a) Northeast Corridor Rail Improvements Program  
It is contemplated that funds will be made available from this program to finance the cost of the new intercity rail improvements and related activities. \$24,670,079
  - (b) Federal Highway Administration  
It is contemplated that funds will be made available from this program to finance the cost of the direct ramp connections into the Intermodal Terminal. \$15,600,000



(c) Urban Mass Transportation Administration

It is contemplated that funds will be made available from this program to finance the cost of various Mass transportation improvements including commuter rail and bus facilities.  
\$13,345,331

Project costs are to be allocated to the various funding sources on the basis of projected funding levels and eligibility criteria (See Table 3).

- (7) Listed below are the potential sources of funding for the non-Federal share of the South Station Project:

City of Boston  
Issuance of BRA Bonds pursuant to State  
legislation recently enacted  
Funding from other local and State  
agencies participating on the project

- (8) Exhibit B from the Boston Redevelopment Authority's Final Application for the Funding of South Station Intermodal Transportation Terminal is a copy of the South Station description on file with the National Register.

- (9)  
256.5(a)(1)

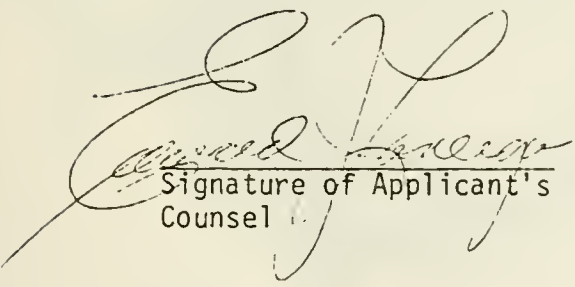
The applicant hereby assures and certifies that he will comply with the regulations, policies, guidelines and requirements of Federal Management Circulars 74-4 and 74-7, as they relate to the application, acceptance and use of Federal funds for this federally-assisted program and with such fiscal control and fund accounting requirements as the Federal Railroad Administrator may establish.

The applicant also gives assurance and certifies with respect to the grant that I will comply with:

- (a) Title VI of the Civil Rights Act of 1964, 78 Stat. 252, 42 U.S.C. 2000d et. seq. and all requirements imposed by Title 49, Code of Federal Regulations, Department of Transportation, Subtitle A, Office of the Secretary, Part 21, Nondiscrimination in Federally-Assisted Programs of the Department of Transportation;

- (b) Title II and Title III of the Uniform Relocation Assistance and Real Property Acquisition Act of 1970, 42 U.S.C. 4001 et seq. and all requirements imposed by Title 49, Code of Federal Regulations, Department of Transportation, Subtitle A. Office of the Secretary, Part 25, Relocation Assistance and Land Acquisition under Federal and Federally-Assisted Programs;
- (c) 42 U.S.C. 4151 et. seq., with regard to Federal policies ensuring that physically handicapped persons will have ready access to, and use of, public buildings;
- (d) The Rehabilitation Act of 1973, 87 Stat. 394, 29 U.S.C. 704, with regard to nondiscrimination under Federal grants;
- (e) The Hatch Act U.S.C. 1501 et. seq. which limits the political activities of employees; and
- (f) Where applicable, the State and Local Fiscal Assistance Act of 1972, 31 U.S.C. 1221 et. seq., and the implementing regulations promulgated thereunder, 31 CFR Part 51; and

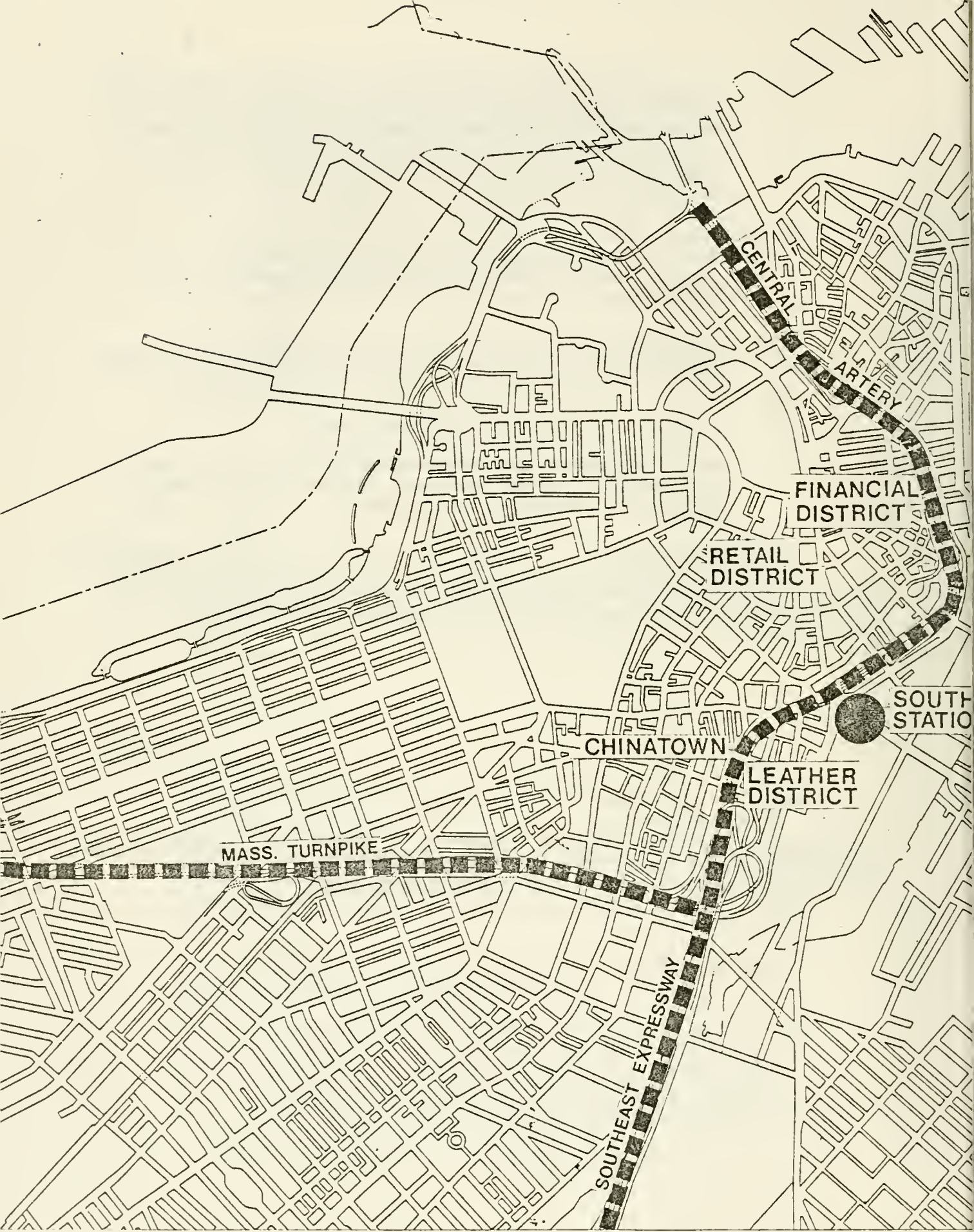
Legal Certification: As counsel for the applicant and attorney-at-law admitted to practice in the State in which the applicant is located, I certify that the facts and representatives contained in the Assurance above to be true and in accordance with State and local law.



Signature of Applicant's  
Counsel

Edward J. Lonergan  
Type or Print Name of  
Applicant's Counsel

26 April 1976  
Date



Map 1

LOCATION OF SOUTH STATION



TABLE 1

## 1990 DESIGN PASSENGER VOLUMES

	Rail		Bus		Total
	Commuter	Intercity	Commuter	Intercity	
Design Day					
Arrivals	7,000	6,425	17,500	8,500	38,925
Departures	7,000	6,425	17,500	8,500	38,925
Peak A.M. Hour					
Arrivals	4,200	700	6,125	850	11,825
Departures	70	700	875	850	2,445
Peak A.M. 15-Min.					
Arrivals	2,800	450	2,100	300	5,630
Departures	70	450	350	300	1,150
Peak P.M. Hour					
Arrivals	70	700*	875	1,280	2,845
Departures	4,200	1,000	6,125	1,280	12,525
Peak P.M. 15-Min.					
Arrivals	70	450*	350	450	1,290
Departures	2,800	650	2,100	450	5,970

\* The peak period for intercity rail arrivals does not occur at the same time as the commuter peak. During the intercity peak hour, 1,000 passengers would arrive, and during the peak 15 minutes 650 would arrive.

TABLE 2

SUMMARY MASTER PLAN CONCEPT FOR INTERMODAL TRANSPORTATION TERMINAL

<u>P r o j e c t      E l e m e n t</u>	<u>No. of Square Feet</u>
<u>New Train Station Concourse</u>	
Level 18: waiting, ticketing, baggage, circulation, curbside drop-off	288,938
Level 30: waiting, circulation, connection to parking	47,585
<u>New Bus Station Concourse / Short-Term Parking</u>	
Level 42: Circulation, parcel pickup	49,194
Parking, 529 spaces; auto pickup-drop off	240,960
Level 54: Arrivals, departures - intercity bus terminal	89,032
commuter bus terminal	237,426
busways: commuter (30 bays)	
long-term parking; intercity (61 bays)	
Level 74: Lobby, rental, access	
parking - 850 parking sapces	21,684
	348,869
Level 84: Lobby, rental, access	8,892
parking, 742 parking sapces	273,100
<u>Parking Drums</u>	78,500
<u>Ramp Connections to Expressway</u>	
<u>Renovation to Headhouse</u>	104,660
<u>Subway Improvements</u>	
Renovation and connector to headhouse	
<u>Track Improvements</u>	
New tracks	12
New high-level platforms	6
Site work, utilities	
Earth work	
Overflow sewer	
Culverts	
East Side Interceptor	



TABLE 3

PROPOSED SCHEDULE OF FUNDING SOURCES

<u>FUNDING SOURCES</u>	<u>TOTAL \$</u>	
I. UMTA (MBTA)		
<u>Commuter Rail</u>		
8 tracks and signals	2,500,000	
4 platforms	1,833,333	
Level 18; 10% of concourse	<u>1,330,500</u>	
	4,663,833	
<u>Commuter Bus</u>		
Bus terminal - level 54	1,702,948	
Busways (30 bays)	<u>1,978,550</u>	
	3,681,498	
<u>Red Line Station Modernization</u>		
Station improvements	4,000,000	
Headhouse connector	<u>1,000,000</u>	
	5,000,000	
Subtotal		13,345,331
II. FHWA (interstate)		
<u>Ramps and drums to bus terminal</u>	12,000,000	
x30% (fees, contingencies)	<u>3,600,000</u>	
Subtotal		15,600,000
III. FRA (Intermodal)		
<u>Intercity Bus</u>		
Level 42 - circulation, lobby	2,548,350	
short-term parking; auto		
drop-off, pickup	3,012,000	
Level 54 - concourse, waiting, ticketing	3,068,647	
bus bays (61), lanes	<u>3,957,100</u>	
	12,586,097	
x 30% (fees, contingencies)	<u>3,775,829</u>	
	16,361,926	

(FRA from previous page)	16,361,926	
<u>Renovation of Headhouse</u>	\$ 3,556,700	
<u>Tenant improvements</u>	1,714,900	
	<u>5,277,600</u>	
Planning/preservation	1,000,000	
Subtotal		22,633,526

#### IV. NORTHEAST CORRIDOR (FRA)

<u>Operational (100% FRA)</u>		
4 tracks and signals	5,000,000	
2 platforms	3,666,667	
Site work, utilities		
earth work	500,000	
overflow sewer	1,100,000	
culverts	2,300,000	
east side interceptor	2,000,000	
Level 18: concourse (90%)		
curb-side access	3,735,125	
Level 30: concourse	<u>2,678,100</u>	
	19,887,423	
<u>Non-operational (50% FAR / 50% City of Boston)</u>		
Level 42: parking (265 spaces)	1,506,000	
1/3 parking garage (522 spaces)		
1/3 parking drum	<u>2,179,198</u>	
	3,685,198	
x 30% (fees, contingencies)	<u>1,097,459</u>	
	4,782,657	
Subtotal		24,670,080

#### V. URBAN SYSTEMS

Summer Street	Subtotal	1,500,000
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#### VI. EDA - Title 10

<u>Clean, paint, light</u>		
<u>outside of headhouse</u>	Subtotal	135,000

## VII. CITY OF BOSTON

### Garage

Level 42 - parking (265 cars)	3,012,000
Level 74 - lobby, circulation	812,940
2/3 parking (580 spaces)	4,035,350
Level 84 - lobby, circulation	365,220
2/3 parking (490 spaces)	3,641,329
2/3 ramps and drums	1,047,724

50% local share NEC Non-operational

Level 42	1,506,000
parking garage, drum	2,179,198
	<u>16,599,762</u>
x 30% (fees, contingencies)	4,979,928
	<u>21,579,690</u>

Site acquisition	9,000,000
Other improvements	<u>5,000,000</u>

Subtotal	35,579,690
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### TOTALS

UMTA	13,345,331
FHWA	15,600,000
FRA (Intermodal)	22,633,526
NORTHEAST CORRIDOR	24,670,079
URBAN SYSTEMS	1,500,000
EDA	135,000
CITY OF BOSTON	35,570,690

<u>GRAND TOTAL</u>	<u>\$113,454,626</u>
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## E X H I B I T S

- A. Site, section plans, space allocation  
description of South Station Intermodal  
Terminal
- B. Demand analysis, Intercity bus.



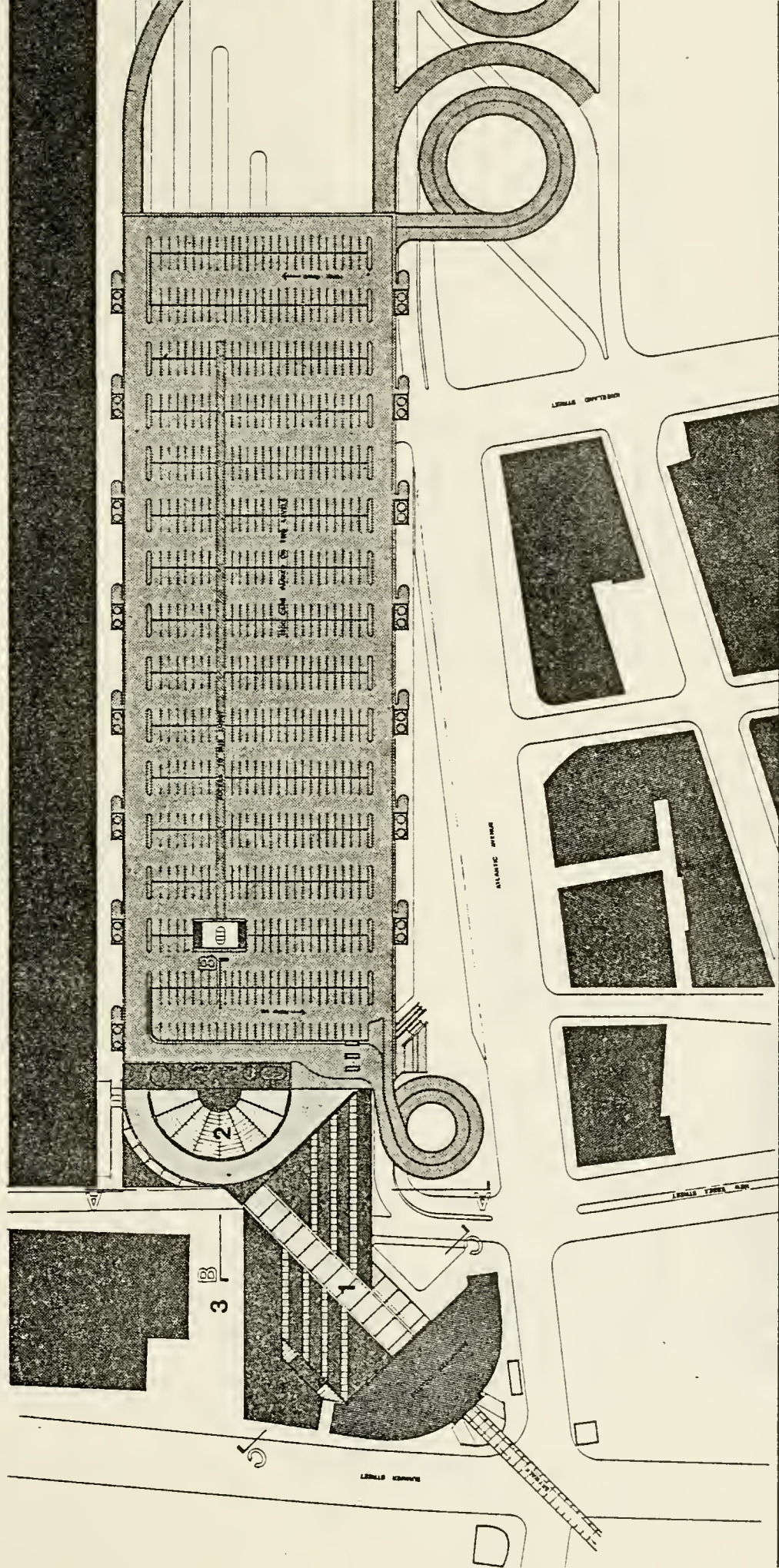


EXHIBIT A





# South Station Site Plan



SOUTH STATION TRANSPORTATION TERMINAL  
BOSTON, MASSACHUSETTS

LEVEL 84



# Alternate 2

## LEVEL 18

Curbside available for rail -  
 580' arrivals  
 480' departures  
 Curbside for city buses 300'  
 Rail head 185' from Stone and  
 Webster property line. No  
 through service road. Parking  
 for 7 medium trucks at rail parcel  
 express.

In Alternate 2 the elevation of rail tracks is lowered to 13.5, roughly their elevation at the southern end of the site. This track elevation allows the high level platforms to be at elevation 18, thus producing a rail level in which platforms, curbside, and all major functions are at the same on-grade level. Furthermore, the rail head can be moved closer to the headhouse because all bus operations have been accommodated on Levels 42 and 54.

### UNHEATED SPACE

12 tracks: 44' spacing of columns  
 between tracks;  
 6 high level platforms 18' wide  
 with no obstructions:

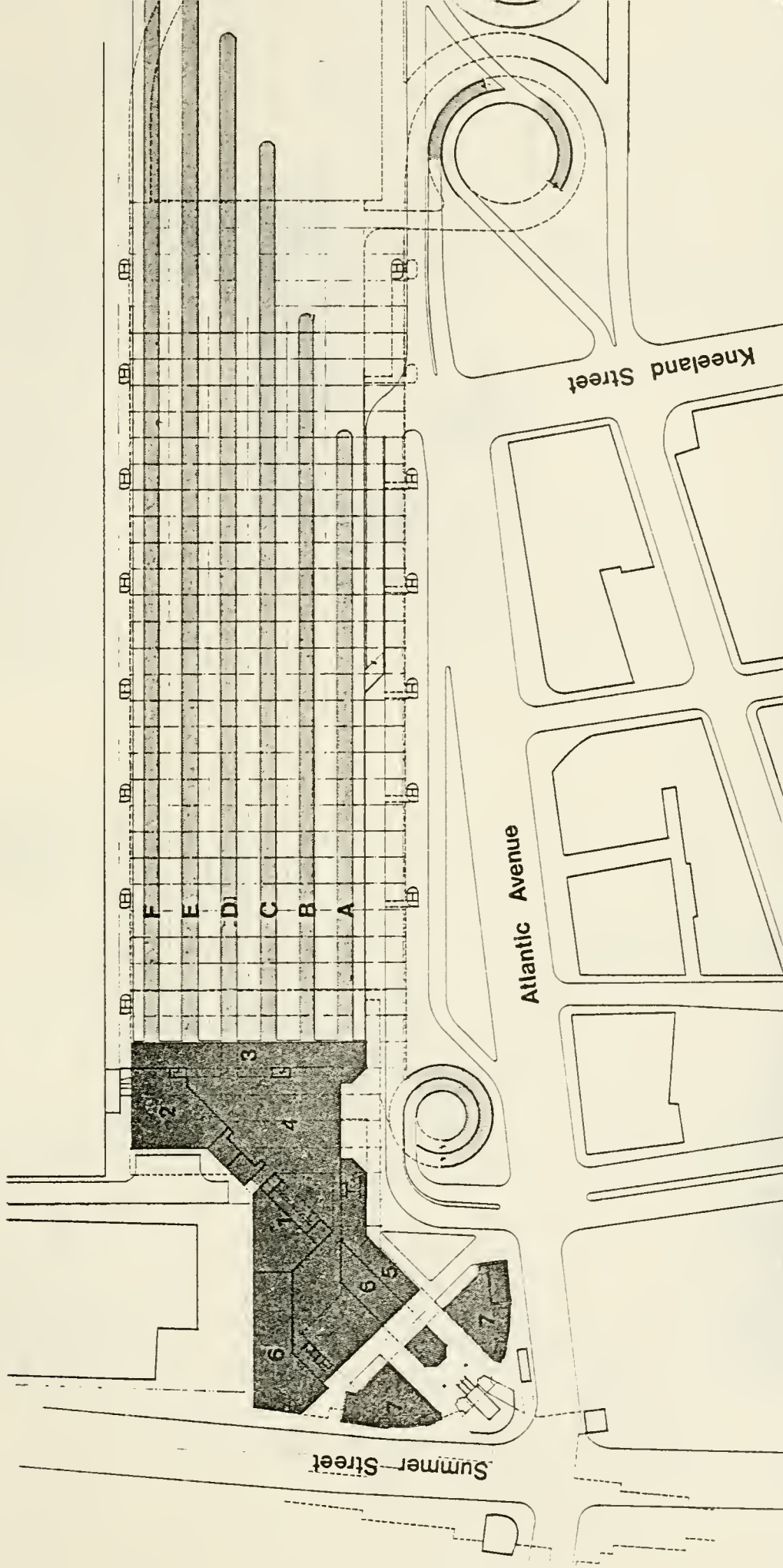
Designation	LF	SF
A Platform 1 Track 1	600	
Track 2	680	12,240
B Platform 2 Track 3	750	
Track 4	830	14,940
C Platform 3 Track 5	910	
Track 6	1,070	19,260
D Platform 4 Track 7	1,265	
Track 8	1,415	25,470
E Platform 5 Track 9	1,415	
Track 10	1,055	25,470
F Platform 6 Track 11	1,070	
Track 12	925	19,260
		<u>116,640</u>

### HEATED SPACE

1 Railroad ticketing, related offices, etc.	6,737
2 Railroad baggage, parcel operation	7,462
3 Feeder concourse to plat- forms	7,950
4 General concourse and wait- ing	19,012
5 General circulation	5,087
subtotal	<u>46,248</u>
6 Rental space	<u>14,935</u>
	<u>61,183</u>
7 Renovated Space (headhouse & east wing)	16,035



# Rail Curbside, Ticketing, Platforms Concessions



SOUTH STATION TRANSPORTATION TERMINAL  
BOSTON, MASSACHUSETTS



0 10 20 30 40 50 60 70 80 90 100

# Alternate 2

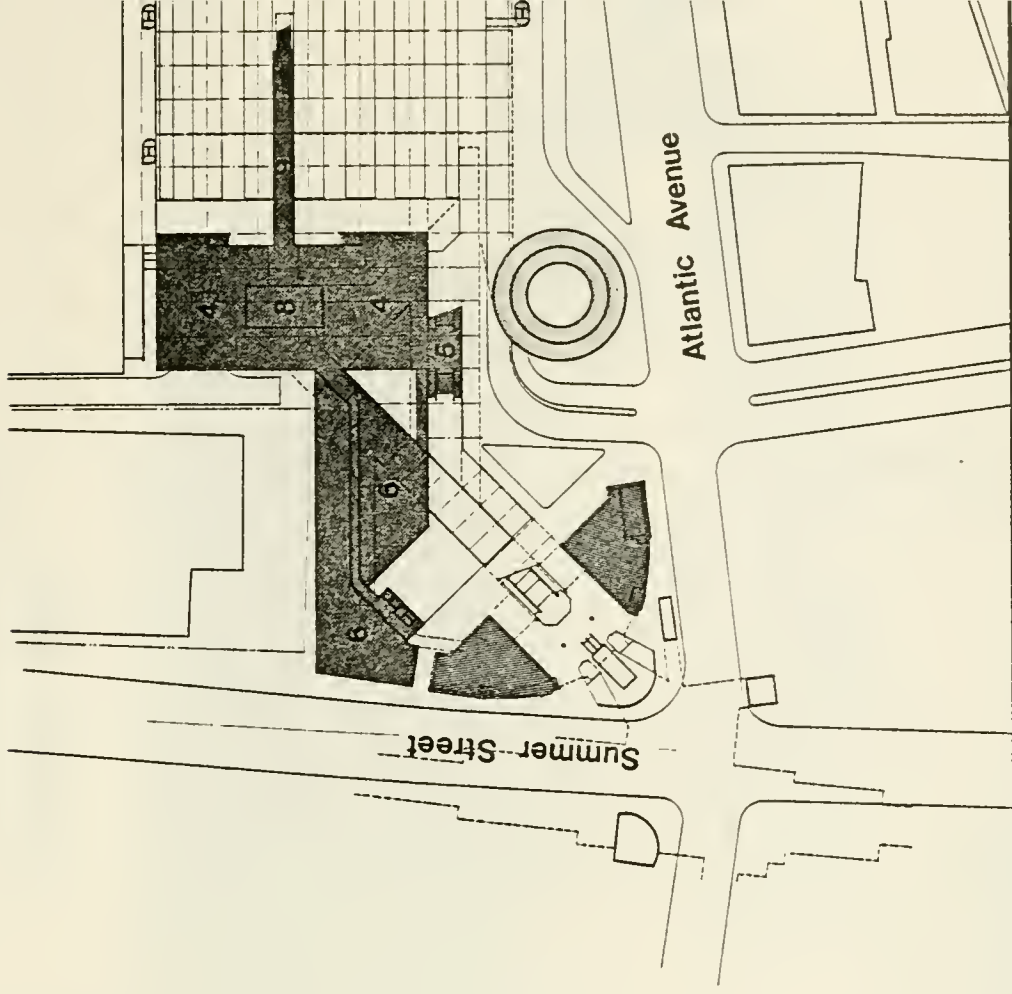
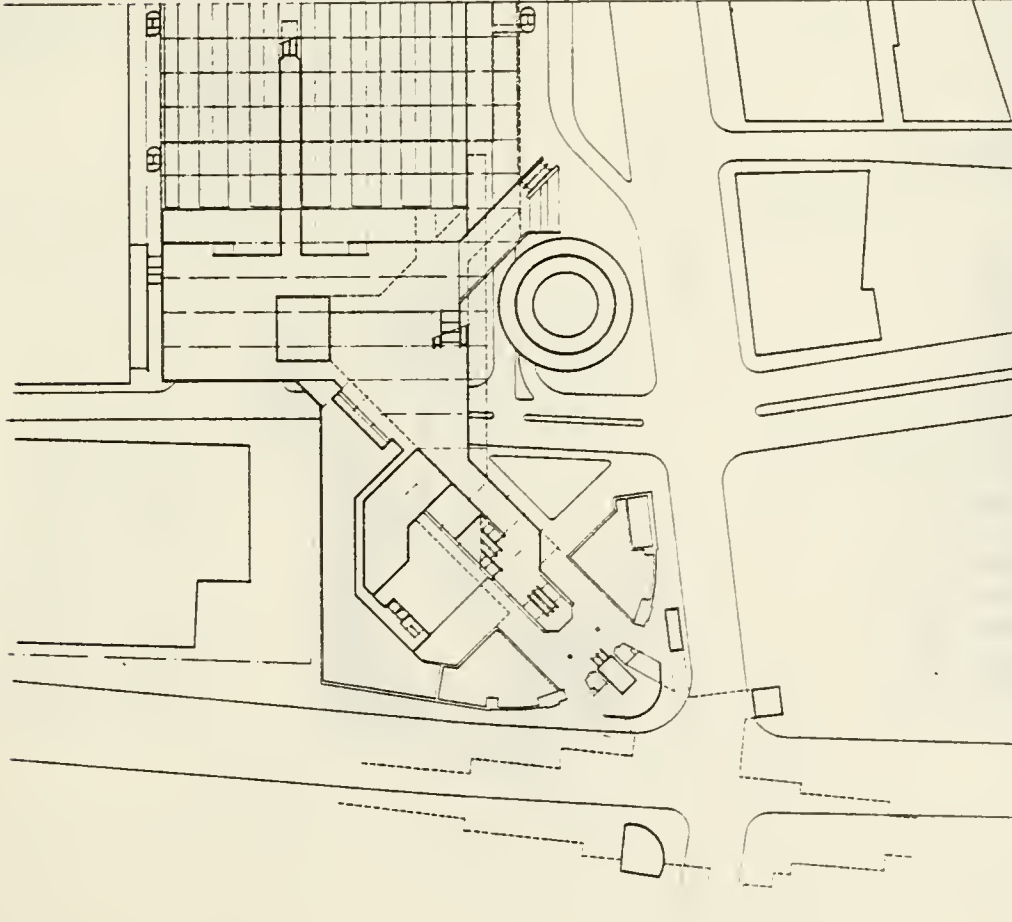
## LEVEL 30

### HEATED SPACE

4	Waiting Area	25,665
8	Toilets, etc.	2,275
5	General circulation	5,280
9	Connector to Parking	2,430
	SUBTOTAL	<u>35,650</u>
6	Rental	<u>11,935</u>
		<u>47,585</u>

Level 30 provides area for seated waiting; major rental space for cafeterias, restaurants and office rental; and circulation between Levels 18 and 42. A connector bridge provides access to short term parking and is stacked over a rail loading platform. The waiting space is oriented to afford direct views of incoming trains on each platform.

# Rail Waiting Concessions



SOUTH STATION TRANSPORTATION TERMINAL  
BOSTON, MASSACHUSETTS



# Alternate 2

## LEVEL 42

As in Alternate 1 Level 42 provides access to commuter and intercity bus at Level 54 from Levels 18 and 30. Also major rental spaces are provided at the headhouse and in new construction at the Stone and Webster property line.

The primary feature of Alternate 2 however is the Level 42 of parking curbside for buses, parcel pickup for buses, and lobby space provided above the rail envelope. Fed by an entrance ramp at Kneeland Street and Atlantic Avenue, this level affords excellent auto access for intercity buses and plenty of short term parking - 529 spaces. Furthermore, the bus parcel pick up area is now only 12 feet below the main bus level thus eliminating elaborate vertical movement of parcels as in Alternate 1. A simple conveyor belt system assures quick and dependable service between the two levels.

### HEATED SPACE

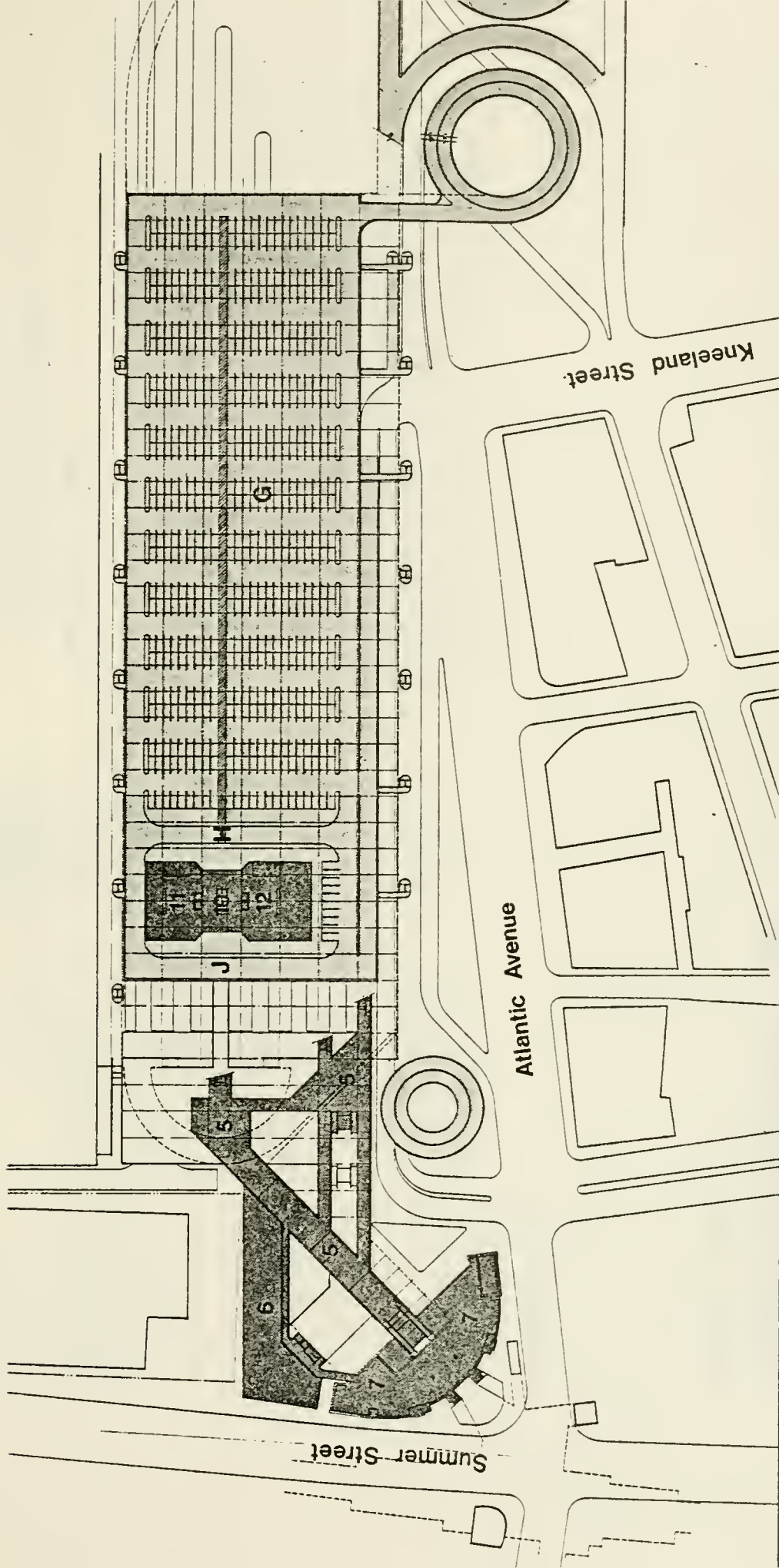
10	Entrance Lobby	3,150
11	Continental Parcel Pickup	5,850
12	Greyhound Parcel Pickup	7,200
5	General Concourse	24,402
	SUBTOTAL	<u>40,602</u>
6	Rental	8,592
		<u>49,194</u>
7	Renovated Space (Headhouse)	14,470

### UNHEATED SPACE

G	529	Parking Spaces
H	190'	Arrivals Curb
J	190'	Departures Curb
	10	Parking Spaces Loading
		Unheated Vehicular/
		Pedestrian
		240,960



# Bus Curbside and Concourse Short Term Parking



SOUTH STATION TRANSPORTATION TERMINAL  
BOSTON, MASSACHUSETTS





# Alternate 2

## LEVEL 54

### HEATED SPACE

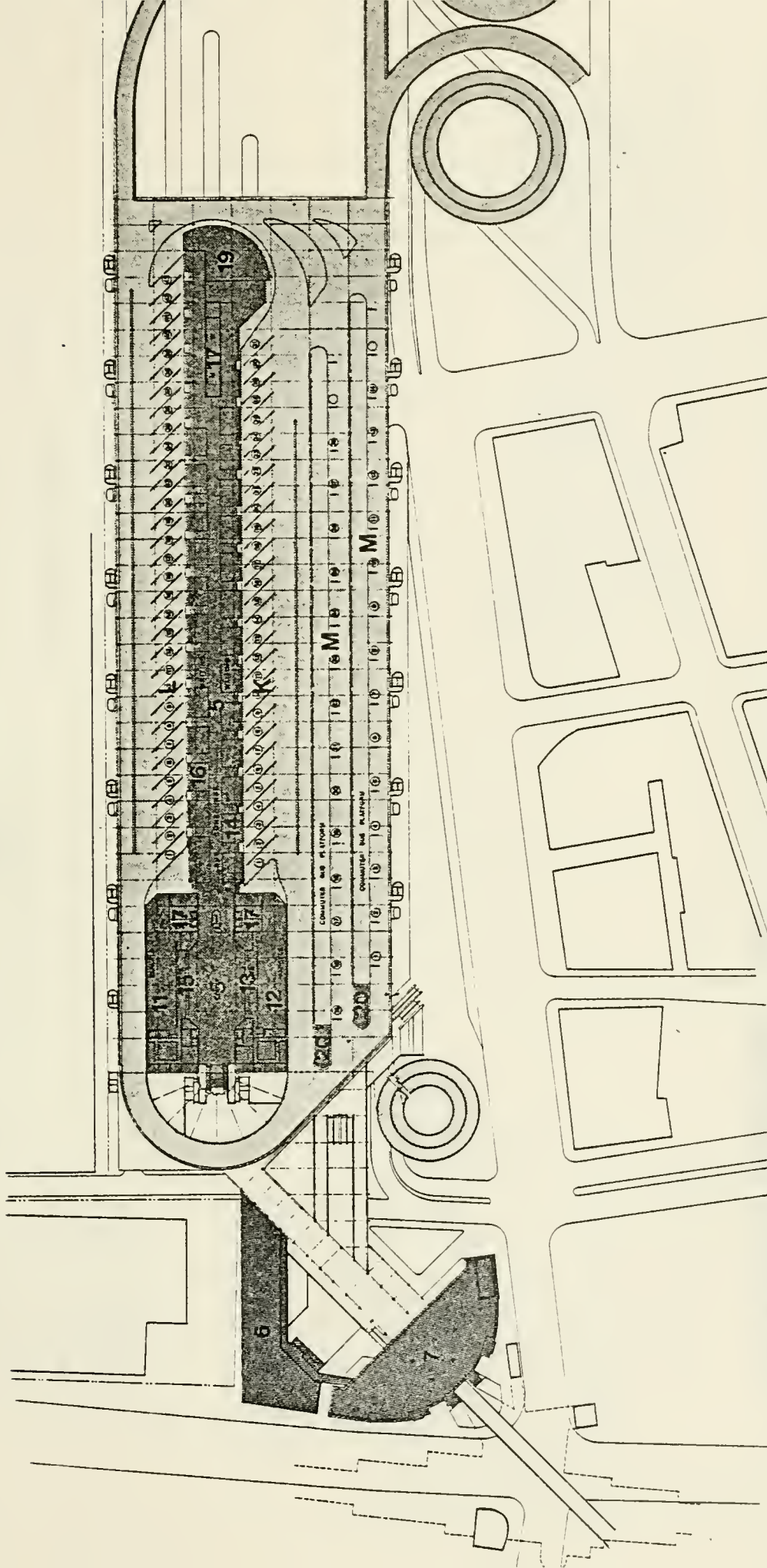
	<u>Greyhound</u>	
13	Ticketing (75' counter)	7,055
	Offices, Support, Toilets	5,135
12	Parcel, Bag Handling	12,375
14	Waiting	
	<u>Continental Trailways</u>	
15	Ticketing (75' counter)	7,055
	Offices, Support, Toilets	5,135
11	Parcel, Bag Handling	10,250
16	Waiting	
5	General Circulation, Lobby	16,925
17	Toilets, Vending	1,650
18	Commuter Bus Waiting	10,735
19	Commuter Bus Operations	4,025
20	Commuter Bus Escalator Lobby	1,600
	SUBTOTAL	<u>81,940</u>
6	Rental	<u>7,092</u>
		<u>89,032</u>
7	Renovated Space (Headhouse & East Wing - Level 58)	24,685

Alternate 2, Level 54, is basically the same as Alternate 1 with the notable exception of its relation to the Level 42 parcel pickup, parking and curbside. These vertical relationships simplify movement on this level and make it much more accessible by car or taxi. It has the same close proximity to the Level 42 concourse and the headhouse and is served by the same expressway ramping system. By the very dimensions of the site - long and narrow - its concourses are long; however, their entry and exit points are as close to the headhouse as possible.

### UNHEATED SPACE

29	Saw-tooth Bus Bays
	West Side
32	Saw-tooth Bus Bays
	East Side
30	Pull through Commuter Bus Bays
	Busways, Loading Platforms, etc.
	237,426

# Intercity and Commuter Bus



SOUTH STATION TRANSPORTATION TERMINAL  
BOSTON, MASSACHUSETTS

LEVEL 54



# Alternate 2

Alternate 2 produces 2121 parking spaces on three levels: 42, 74, and 84. Addition of another level at 94 would increase this to 2971 spaces. For this preliminary stage of design, three levels were considered adequate, but should additional parking be needed a Level 94 can be added.

## LEVEL 74

### HEATED SPACE

5 Elevator Lobby	1,800
21 Mechanical	5,700
	<u>7,500</u>
6 Rental (at Levels 66,78)	14,184
	<u>21,684</u>
SUBTOTAL	

### UNHEATED SPACE

G 850 Parking Spaces	
355 sf/space	
Parking Deck	302,500

## LEVEL 84

### HEATED SPACE

5 Elevator Lobby	1,800
6 Rental (at Level 90)	7,092
	<u>8,892</u>

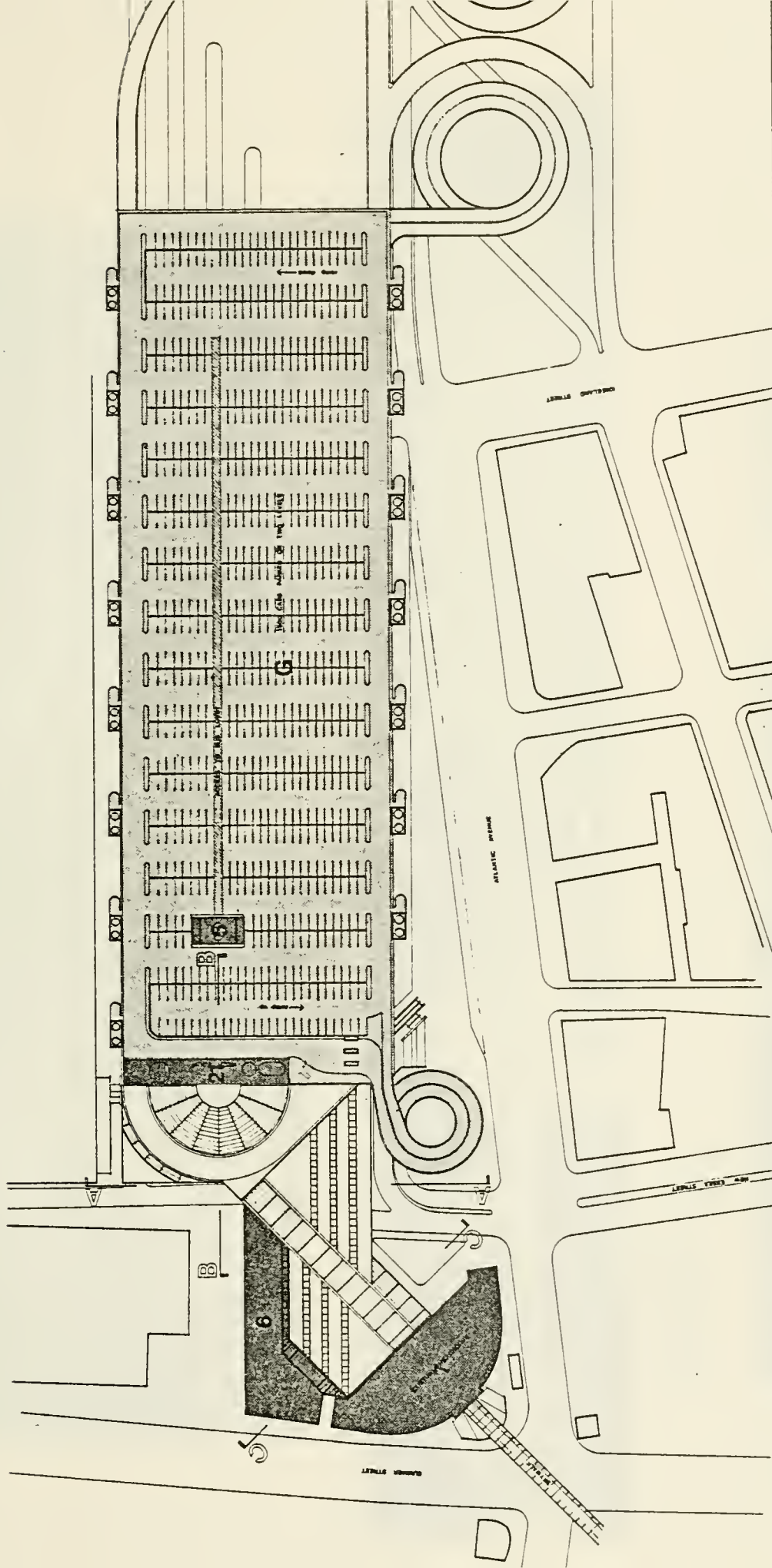
### UNHEATED SPACE

G 742 Parking Spaces	
368 sf/space	
Parking Deck	273,100

7 Renovated Space (Headhouse  
at Level 90 & East Wing)



# Parking



SOUTH STATION TRANSPORTATION TERMINAL  
BOSTON, MASSACHUSETTS

LEVEL 84



0 30 60 120 240

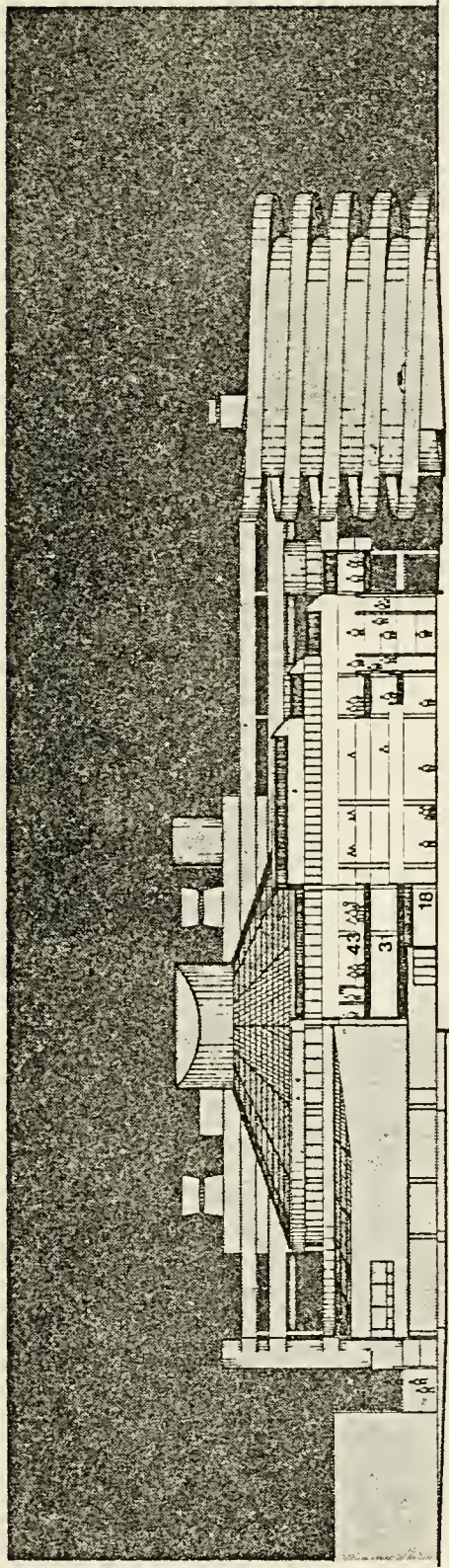
# Alternate 2

# TOTAL BUILDABLE SPACE

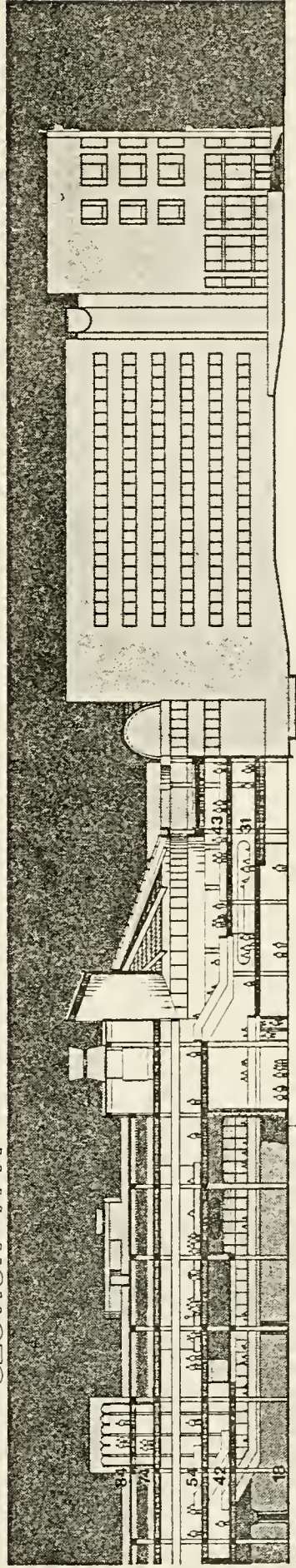
	Heated	Unheated	Renovated	Rental
Level 18	46,248	116,640	16,035	14,935
Level 30	35,650	---	---	11,935
Level 42	40,602	240,960	14,470	8,592
Level 54	81,940	237,426	---	7,092
Level 58	---	---	24,685	---
Level 66	---	---	---	7,092
Level 74	7,500	302,500	24,685	---
Level 78	---	---	---	7,092
Level 84	1,800	273,100	---	---
Level 90	---	---	24,685	7,092
TOTAL SF.	213,740	1,170,626	104,560	63,830



# Alternate 2



SECTION A-A



SECTION B-B

SOUTH STATION TRANSPORTATION TERMINAL  
BOSTON, MASSACHUSETTS

SECTIONS  
1 2 3 4 5 6



E X H I B I T       B



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SOUTH STATION  
TRANSPORTATION CENTER

Technical Memorandum #2  
FUTURE INTERCITY AND COMMUTER BUS PATRONAGE

Prepared for the  
Boston Redevelopment Authority

February 2, 1976

Parsons, Brinckerhoff, Quade & Douglas, Inc.  
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This Technical Memorandum is one of a series developed as part of a programming effort for the South Station Transportation Center. Its purpose is to document the estimates of future bus patronage which will form the basis for design of the Transportation Center. It has been prepared using available information from a variety of sources. Its adequacy as a basis for design should be established only after consideration of the assumptions and source data employed.



## Technical Memorandum #2

### FUTURE INTERCITY AND COMMUTER BUS PATRONAGE

This memorandum looks at patronage on the bus lines and routes that are considered likely to use a consolidated Transportation Center at South Station. All of the privately owned bus lines that presently use the Greyhound and Trailways bus terminals in the Park Square area, as well as the four Turnpike Express routes operated by the MBTA that serve the downtown area near South Station are considered. Local MBTA bus routes in the South Station area, which provide downtown distribution and serve South Boston are not considered in this analysis.

#### Type of Service

In order to project future bus patronage, it is necessary to classify the bus operations likely to use the Transportation Center as to the type of service they provide. The basic classifications are commuter and intercity. This distinction is necessary because patronage projections are calculated differently for the various types of service and because the Transportation Center will have separate bus facilities for serving intercity and commuter buses and passengers.

Commuter buses carry people between a central core city and its surrounding suburban area. Commuters generally ride the same bus route each day, and their ultimate destination is usually close to the point of disembarkation. Some of the characteristics of commuter bus operations are: (a) shorter routes than intercity operations, usually between a large city and its surrounding suburbs or satellite cities; (b) more frequent service provided inbound during the morning peak hours and outbound during the afternoon peak; (c) more buses scheduled on weekdays than on weekends; (d) different types of equipment, commuter buses resembling local city buses rather than intercity buses.

The bus lines likely to use the South Station Transportation Center are placed in four classifications: MBTA express buses, privately-owned commuter lines, mixed commuter/intercity lines, and exclusively intercity bus lines. Table 1 assigns the bus lines to these categories.

In this analysis MBTA buses are kept separate from the others. Operated by a public agency, their mode of operation differs somewhat from the other bus lines. MBTA Turnpike express bus routes that serve the South Station area are #300 from Riverside, #301 from Brighton Center, #304 from Watertown Square, and #305 from Waltham. The equipment used on these routes is similar to MBTA city buses. Fare is collected on board.

The bus lines classed as "private commuter" serve the Greyhound or Trailways terminals from cities and towns around Boston. Wellesley Fells makes a number of stops along Route 9 between Boston and Framingham. ABC has a similar service along Route 1 between Boston and Providence, and Ritchie along Route 20 between Boston and Northboro. Boston Commuter lines serves Haverhill and Lawrence, and Hudson serves Peabody, with mostly peak hour operations. Gray Line has some characteristics of intercity bus lines (package express service is offered and intercity type coaches are used) but has a heavy peak period patronage and would be likely to use commuter platforms in the Transportation Center. During peak periods Gray Line buses are dispatched on a "load-up-and-go" basis.

Several bus lines exhibit some of the characteristics of both commuter and intercity operations, and are placed in the "mixed" category. All use intercity type coaches and offer express package service. In the Transportation Center, these lines might use commuter platforms during peak hours, but also might operate some departures from saw-tooth intercity platforms. Plymouth & Brockton (whose schedule incorporates Brush Hill service) is oriented toward commuter service. It has more than half of its arrivals scheduled between 7 and 9 a.m. and serves some of the South Shore suburbs fairly close to Boston. Plymouth & Brockton also provides service to Hyannis on the Cape, with a good deal of resort traffic, and would be likely to operate some service from the intercity terminal. Almeida also serves Cape Cod but also has commuter-oriented service to Middleboro and New Bedford. Bonanza serves Providence, Newport, and Fall River, and its schedule indicates that some of the buses are scheduled to serve commuters as well as intercity travelers. Likewise, Englander provides service to Fitchburg and points west, and Trombley to Lawrence and Andover, both providing service throughout the day but with a somewhat heavier schedule during the commuter peak periods.

The other bus lines, Greyhound, Vermont Transit, Michaud, Trailways, and Peter Pan are classed as intercity carriers. Except for Peter Pan, all provide interstate service only. None of these lines serve places considered to be within normal commuting distance.



TABLE 1

CURRENT BUS ARRIVALS AND DEPARTURES  
(From Schedules)

	<u>DAILY</u>		<u>PEAK</u>	
	<u>Arr.</u>	<u>Dep.</u>	<u>(7-9)</u> <u>Arr.</u>	<u>(4-6)</u> <u>Dep.</u>
<u>MBTA</u> 2/6/75				
300	43	43	20	19
301	31	31	15	16
303	79	79	28	21
305	22	22	5	7
	<u>175</u>	<u>175</u>	<u>68</u>	<u>63</u>
<u>Private Commuter</u>				
Gray Line 10/10/75	57	53	21	19
Wellesley Fells 3/9/74	13	15	5	4
Ritchie 3/4/74	5	5	3	3
ABC 12/11/75	10	11	3	2
Boston Commuter 9/27/74	10	11	6	7
Hudson 7/24/75	4	3	4	3
	<u>99</u>	<u>98</u>	<u>42</u>	<u>38</u>
<u>Mixed</u>				
Almeida 9/15/75	33	33	12	10
Trombly 4/21/74	15	15	4	4
Bonanza 10/26/75	34	34	7	7
Englander	12	11	2	2
Plymouth & Brockton 9/6/75	85	87	46	45
	<u>179</u>	<u>180</u>	<u>71</u>	<u>68</u>
<u>Intercity</u>				
Greyhound 10/26/75	37	37	1	6
Vermont 10/26/75	19	18	0	3
Michaud 9/12/74	2	2	0	0
Trailways 10/26/75	29	27	3	5
Peter Pan 9/8/75	21	21	2	5
	<u>108</u>	<u>105</u>	<u>6</u>	<u>19</u>
	===	===	===	===
	561	558	187	188

## Present Volumes

Table 1 shows the current numbers of daily and peak-period bus arrivals and departures for each of these bus lines, as obtained from published schedules. The peak period for commuter service is defined as 7-9 a.m. for arrivals in Boston and 4-6 p.m. for departures from Boston. Current operating schedules show a total of about 560 bus arrivals and a similar number of departures on a normal weekday. Commuter operators generally reduce schedules on weekends. Intercity bus lines, on the other hand, sometimes add buses on weekends, especially Friday and Sunday, when intercity bus traffic peaks. In addition to the scheduled movements shown on Table 1, the intercity and mixed bus lines schedule 13 additional arrivals and 14 departures for Friday only. Beyond these additional scheduled buses, the intercity operators generally add extra sections to their scheduled departures, as needed, to accommodate peak period vacation and holiday traffic.

Daily bus ridership estimates (for 1975) are shown in Table 2 for each type of service. Private commuter, mixed, and intercity ridership estimates were made from 1972 Boston Cordon Count data. Raw data were available for some bus lines showing the number of people on each arrival and departure. For other lines, data showed the number of arriving and departing passengers only for each six-hour period. An hourly distribution was made, either to correspond with the distribution of scheduled buses, or to correspond with the hourly distribution of intercity rail traffic. For other lines, no data was available, and patronage was distributed so that the total number of riders would match the total non-MBTA bus ridership for each hour, as shown in Tables 3 and 4 of the published 1972 Cordon Count for downtown Boston. Some non-MBTA bus routes which do not serve the Greyhound or Trailways terminals have not been removed from the data in Table 2, but these are few and do not significantly affect the analysis. To update these ridership counts to reflect current estimates, all ridership categories were multiplied by a factor of the increase shown by the 1974 Cordon Counts over 1972. In 1974, the year of the "gas crisis" there was a sharp growth in use of public transportation. For 1975, little or no additional growth has been apparent. (Cordon count dates for 1972 were June 19, 20 and 21; for 1974, June 24, 25, and 26.)

For the four MBTA express routes, MBTA data was made available giving peak period ridership for February 6, 1975 (generally 7-9 a.m. inbound and 4-6 p.m. outbound). Off-peak ridership was estimated by assuming an average of 20 passengers per scheduled bus.

TABLE 2

## COMMUTER AND INTERCITY PASSENGERS, 1975

		Type of Service		
		Private		
<u>Arrivals</u>	<u>MBTA</u>	<u>Commuter</u>	<u>Mixed</u>	<u>Intercity</u>
Peak Period (7-9 A.M.)	3,139	1,570	2,204	
Off Peak	1,360	1,353	1,660	
Daily	4,499	2,923	3,864	2,639
<u>Departures</u>				
Peak Period (4-6 P.M.)	3,149	1,455	1,959	
Off Peak	1,260	1,681	2,148	
Daily	4,409	3,136	4,107	2,799

Daily ridership estimates from these four categories of buses were then apportioned between commuter and intercity passengers, to determine the numbers of people who might be likely to use the different facilities in the new terminal. Commuters here include all MBTA express bus and private commuter bus riders, as well as all peak-period (7-9 a.m. inbound, 4-6 p.m. outbound) passengers on mixed lines and half of the off-peak passengers on mixed lines. Intercity passengers include the remaining half of the off-peak riders on mixed lines and all riders on the intercity lines. Since the cordon counts were obtained over a three-day period, inbound and outbound ridership data were different.

The following table presents estimates of 1975 daily commuter and intercity passenger and bus movements, combining arrivals and departures.

TABLE 3

1975 DAILY COMMUTER AND INTERCITY VOLUMES  
ARRIVALS & DEPARTURES

	<u>COMMUTER</u>				<u>INTERCITY</u>		
	<u>MBTA</u>	<u>Private</u>	<u>Mixed</u>	<u>Total</u>	<u>Mixed</u>	<u>Inter- city</u>	<u>Total</u>
Passengers	8,908	60,060	6,066	21,034	1,904	5,438	7,342
Buses	350	196	250	796	110	214	324

In order to project 1990 intercity bus patronage, an estimate of annual intercity patronage will be needed. Intercity traffic varies considerably by day of the week and by season of the year. The cordon counts, on which estimates of daily intercity patronage are based, were obtained on a Monday, Tuesday and Wednesday in later June. Late June is the start of the summer travel season, but travel during the Monday through Wednesday period is below the weekend peaks. The cordon count based patronage then should be close to the arithmetical average for daily traffic throughout the year. As a check, reference is made to data on intercity rail traffic from Boston, which should show a distribution pattern similar to that for intercity bus traffic. A late June weekday is assumed to be near the 150 th busiest day of the year, coming after 100 busier weekend days and 50 busier holiday and somertime travel days. From Figure 3.3 of the FRA Task 1 Report, the 100th busiest day for intercity rail traffic would see 0.23 percent, and the 200th busiest day 0.33 percent, of annual traffic. The median of these values, .28 percent is very close to (1.02 times) the

daily average. Therefore, the daily volumes will be multiplied by 365 in order to estimate yearly intercity bus patronage.

This process yields an annual bus passenger volume (arrivals plus departures) of 2,286,000 for 1972 and 2,680,000 for 1974. Taking the mean of these to get 1973 patronage gives an estimate of 2,483,000 intercity bus passenger movements in Boston. In FRA Task 1 (Table 3.2) it is estimated that 734,000 of these intercity bus passenger movements were between Boston and other cities along the Northeast Corridor Rail route. The remaining 1,749,000 trips were between Boston and "non-corridor" locations.

### Commuter Bus Projections

Commuter bus patronage is estimated for the year 1990. Future commuter bus ridership will depend on several factors, among them: (a) changes in regional populations, (b) changes in downtown employment, and (c) changes in commuting habits. In the following paragraphs the effects of each of these factors are evaluated separately and then combined.

Population. A number of population projections made for the Boston region in recent years were compared. For projecting commuter bus ridership, changes in population in the areas served by the buses are more important than overall changes in the regional population. The most important commuter bus market areas in the BTPR region are the Southeast Sector and the West Sector. Population projections for these sectors for 1990 range from 840,300 down to 806,500. The higher projection, made in 1970 as part of Task A of the transportation planning review process, is a result of a 19.7 percent growth over estimated 1975 population. The lower projection, developed for the MDC in 1974, is a growth of 14.9 percent over 1975. The MDC projection is based on later population data and reflects more current birth rates and migration patterns.

Employment. The South Station Urban Renewal Area Environmental Impact Report gives several estimates of employment increases for 1980 in the downtown area. When projected on a straight-line basis to 1990, these increases range from a low of five percent (MDC forecast for total employment) to a high of about 50 percent (BRA forecast for office workers). A fifty percent increase does not appear reasonable, but the dispersion of employment to the suburbs has slowed down and in downtown employment greater than the low estimate seems likely by 1990.



The factors for employment and population growth are combined to produce an overall employment-population multiplier. Since the population and employment factors represent changes in potential commuter trip origins and destinations, the combined factor would lie somewhere between the two. At its lowest, the combined factor would reflect the lower of either population or employment growth; at its highest, it would equal the higher of either employment or population growth. The most likely combined multiplier would be some average of the population and employment factors.

<u>Population - Employment Multiplier 1975-1990</u>			
	<u>Low</u>	<u>High</u>	
	<u>Potential</u>	<u>Potential</u>	<u>Likely</u>
Population Factor	1.15	1.20	1.15
Employment Factor	1.05	1.50	1.15
Combined Population-Employment Multiplier	1.05	1.50	1.15

Shifts in downtown employment location could also affect the number of bus commuters. The South Station Environmental Impact Report estimates that upon completion of the urban renewal project, employment in the immediate vicinity of South Station will be 27,200, an increase of 19,150 over 1975 employment. The convenience of the location will attract some of these employees to commuter buses.

The Boston Cordon Count shows that during peak hours, approximately 50 percent of the commuters arrive in downtown Boston in private automobiles. Without any detailed information on mode shift due to employment location, it is estimated that up to 20 percent of these automobile riders would be able to use commuter buses to get to work and would do so because of the locational convenience. This is 10 percent of the new employees in the vicinity, or about 1,900 people, who would use commuter buses, in addition to those throughout the downtown area who would choose that mode because of general employment and population increases. This figure can be added directly to the 1990 design day commuter bus projections.

Commuting Habits. A final factor that must be considered is the possible change in commuting habits and a shift towards public transportation as a result of energy shortages and public policy decisions. Public policy seems to have been firmly established to encourage use of public transportation, so it does not seem likely that this factor would result in a lessening of commuter bus patronage. At the least, bus commuting habits would remain unchanged from the present and this factor would be unity. The highest value for this factor is hard to gauge. With a concerted public

policy effort to encourage use of public transportation, along with a recurrence of gasoline shortages and rapidly rising prices, use of public transportation might increase 50 percent over what it otherwise might be without this factor. A value of 1.5 was therefore chosen as the high potential for this factor.

This factor is then combined with the Population-Employment multiplier:

	<u>Composite Growth Multiplier</u>		<u>1975-1990</u>
	<u>Low</u>	<u>High</u>	
	<u>Potential</u>	<u>Potential</u>	<u>Likely</u>
Population-Employment Multiplier	1.05	1.50	1.15
Commuting Habits Multiplier	1.00	1.50	1.20
Composite Growth Multiplier (Product of the above)	1.05	2.25	1.38

#### Intercity Bus Projections

The analyses of intercity bus patronage for 1990 are done separately for Northeast Corridor traffic and non-corridor traffic. In the Northeast Corridor (cities along the Eastern seaboard between Boston and Washington), some diversion of passenger traffic from bus to rail is expected due to planned upgrading of corridor rail service by 1990. For non-corridor intercity bus traffic, diversion to rail is not considered a factor in projecting 1990 patronage. Projections of 1990 patronage for both corridor and non-corridor traffic are based on the demand analysis for intercity rail service done for the Federal Railroad Administration and documented in Northeast Corridor High Speed Rail Passenger Service Improvement Project, Task 1, Demand Analysis, April, 1975; and on the adjustments to that analysis discussed in PBQD Technical Memorandum Future Intercity Rail Patronage, January 5, 1976

Northeast Corridor Bus Ridership Projections. Estimates of 1990 ridership along the Northeast Corridor are based on an analysis presented in the FRA Task 1 Report and reapplied using revised base data in PBQD Technical Memorandum #1. The revised estimates are computed using an intercity travel growth multiplier of 1.40 based on the latest available 1990 population and person income forecasts for the Boston region and a modal split factor based on 4-hour Corridor rail travel time from Boston to New York. The following table summarizes the derivation of 1990 bus ridership between Boston and other Northeast Corridor cities.

<u>Between Boston And...</u>	<u>1973 Person Trips (000's)</u>	<u>Most Likely 1990/1973 Growth Multiplier</u>	<u>1990 Person Trips (000's)</u>	<u>Bus Mode Share (%)</u>	<u>1990 Bus Person Trips (000's)</u>
Providence	9,053	1.40	12,674	2.5	319
New London	668	1.40	935	2.8	26
New Haven	725	1.40	1,015	11.9	121
Bridgeport	476	1.40	666	4.4	29
New York	5,852	1.40	8,193	4.7	385
Trenton	94	1.40	132	.8	1
Philadelphia	1,064	1.40	1,490	.8	12
Wilmington	119	1.40	167	1.0	2
Baltimore	289	1.40	405	1.6	6
Washington	<u>1,144</u>	<u>1.40</u>	<u>1,601</u>	<u>1.6</u>	<u>26</u>
TOTAL	19,484	1.40	27,278		927

Application of low and high 1990/1973 growth multiplier - 1.35 and 1.77 respectively - yields a range of 1,889,000-3,096,000 bus trips between Boston and other corridor cities in 1990.

Non-Corridor Projections. The 1974 intercity bus passenger traffic between Boston and non-corridor locations was estimated earlier in this analysis at 1,749,000 movements. No diversion from bus to rail is expected on traffic between Boston and non-corridor cities, since no sub-stantial upgrading of rail service is anticipated by 1990. The growth multipliers obtained previously are applied to 1973 patronage to yield estimates of 1990 intercity bus patronage between Boston and non-corridor cities:

	<u>Non-Corridor Bus Person Trips</u>		
	<u>Low</u>	<u>High</u>	<u>Likely</u>
1973 Patronage	1,749,000	1,749,000	1,749,000
Growth Multiplier	1.08	1.77	1.33
1990 Patronage	1,889,000	3,096,000	2,274,000

Combined Projections. The forecasts of corridor and non-corridor bus patronage are combined to get a projection of total 1990 intercity bus patronage to and from Boston.

1990 Intercity Bus Patronage

	<u>Low Potential</u>	<u>High Potential</u>	<u>Likely</u>
Northeast Corridor	834,000	1,172,000	927,000
Non-Corridor	1,889,000	3,096,000	2,274,000
Total	2,723,000	4,268,000	3,201,000

Design Day Volumes

Commuter Buses. MBTA Ridership Data for the South Shore extension of the Red Line were used to obtain seasonal patterns of commuter patronage. This transit extension principally serves commuters to downtown Boston, and it is assumed that variation in daily ridership throughout the year would closely parallel that on commuter bus lines. Average daily ridership during February, the month when ridership is highest, is used to establish design-day volumes for commuter bus lines serving South Station. Patronage forecasts for privately-owned commuter bus lines are based on cordon count data obtained on a Monday, Tuesday and Wednesday in late June. For the South Shore transit extension the average daily ridership for February is approximately 13 percent higher than during the late June period during which the cordon counts were made. Because MBTA ridership data were obtained in February, the design-day factor is unity.

To get 1990 design-day volumes, the daily ridership estimates on private commuter and mixed lines (from Table 3) are multiplied by the growth multipliers and design day factor and further adjusted to reflect an anticipated shift in downtown employment to the vicinity of South Station.



Commuter Bus Patronage Forecasts

	<u>MBTA</u>			<u>Other</u>			<u>Total</u>		
	<u>Low</u>	<u>High</u>	<u>Likely</u>	<u>Low</u>	<u>High</u>	<u>Likely</u>	<u>Low</u>	<u>High</u>	<u>Likely</u>
1975 1-day Ridership	8,908	8,908	8,908	12,126	12,126	12,126	21,034	21,034	21,034
Growth Multiplier	1.05	2.25	1.38	1.05	2.25	1.38	--	--	--
Design Day Factor	1.00	1.00	1.00	1.13	1.13	1.13	--	--	--
Unadjusted 1990 Design Day	9,400	20,000	12,300	14,400	30,800	18,900	23,800	50,800	31,200
Employment Shift Ad- justment							0	6,000	3,800
1990 Design Day							23,800	56,800	35,000

Intercity Buses. Intercity bus patronage is assumed to show seasonal variation similar to that of intercity rail at Boston. PBQD Technical Memorandum #1 recommended that design day patronage for intercity rail be established at 0.5 percent of annual patronage. This factor is also applied to the 1990 intercity bus patronage estimates obtained previously.

1990 Design-Day One Way Intercity Bus Patronage

	<u>Low Potential</u>	<u>High Potential</u>	<u>Likely</u>
1990 Annual Patronage	2,723,000	4,268,000	3,201,000
Design-Day Factor	0.005	0.005	0.005
1990 Design Day	13,600	21,300	16,000



## Time Distribution

Table 4 shows the hourly variation in ridership on privately-owned commuter, mixed, and intercity bus lines, as based on cordon count data. The distribution is similar for commuter and mixed buses, with about 30 percent of daily arrivals during the morning peak hour and 33 percent of daily departures during the afternoon peak hour. For intercity bus ridership, both the arrival and departure peaks occur between 4 and 5 p.m., with an estimated 12 percent of arrivals and 14 percent of departures during that hour.

The cordon counts, which show movements for each half hour, indicate that commuter arrivals and departures during the two adjacent peak hours are concentrated in the adjacent half-hour segments. For Transportation Center design, it is recommended that 35 percent of daily commuter arrivals or departures be assumed to occur during the peak hour, 20 percent during the peak half hour, and 12 percent during the peak 15 minutes. Patronage in the off-peak direction during the peak hour is arbitrarily set at 5 percent of daily volumes, 3 percent during the peak half-hour, and 2 percent during the peak 15 minutes.

It is recommended that peak hour intercity arrivals and departures be established as 15 percent of daily volumes, and that both peak arrival and departure periods be assumed to occur at the same time as peak commuter departures. During the peak hour for commuter arrivals, intercity arrivals and departures are set at 10 percent of daily volumes. As was assumed for intercity rail patronage, peak half-hour volumes are set at 65 percent of peak hour, and peak 15-minute volumes at 35 percent of peak hour.

These peak period percentages are applied to design day commuter and intercity patronage forecasts, and the peak-period design volumes are presented in Table 5.

## Submode of Travel

The mode of travel that intercity and commuter bus passengers will use between the Transportation Center and their point of origin or destination in Boston has important implications in Transportation Center design.

A survey conducted by PBQD in November, 1975\* provided data on the submode of travel now used by commuter bus passengers arriving on Essex Street at the various terminals. The survey results for Essex Street in the vicinity of South Station, are shown below, along with suggest submodal split percentages to be used in design of the Transportation Center. Percentages using local bus or

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\*Parsons, Brinckerhoff, Quade & Douglas, Inc., Report of South Station Commuter Survey, conducted for the Boston Redevelopment Authority, January 19, 1976.

TABLE 4

## COMMUTER/INTERCITY BUS RIDERSHIP TIME DISTRIBUTION (PERCENT)

Hour Beginning	ARRIVALS			DEPARTURES		
	Commuter	Mixed	Intercity	Commuter	Mixed	Intercity
6 A.M.	5	2		2	1	3
7	29	30	3	3	1	4
8	25	27	10	3	3	8
9	4	8	8	5	6	5
10	4	5	6	2	2	6
11	2	3	5	4	7	5
Noon	2	3	7	1	2	7
1	4	2	5	4	2	5
2	3	4	4	2	4	5
3	4	2	5	6	5	8
4	4	1	11	13	15	9
5	6	2	12	33	32	13
6	3	5	5	8	12	7
7	2	3	9	4	3	8
8	2	1	4	4	1	4
9		1	5	3	1	1
10			1	1		2
11	1	1		2	3	
Total	100%	100%	100%	100%	100%	100%

TABLE 5  
1990 DESIGN PASSENGER VOLUMES

<u>Peak Period</u>	<u>Commuter</u>		<u>Intercity</u>	
	<u>Arr.</u>	<u>Dep.</u>	<u>Arr.</u>	<u>Dep.</u>
Design Day	17,500	17,500	8,000	8,000
8-9 A.M., 60 minutes	6,125	875	800	800
30 minutes	3,500	525	520	520
15 minutes	2,100	350	280	280
5-6 P.M., 60 minutes	875	6,125	1,200	1,200
30 minutes	525	3,500	780	780
15 minutes	350	2,100	420	420

subway are adjusted upward from the survey results to account for increased use during bad weather and possible changes due to moving bus lines from other terminals to South Station.

The FRA Task 7A report\* presents 1990 submodal splits assumed for intercity rail travel at the Northeast Corridor stations. These are accepted as valid for intercity bus passengers as well. The high and low estimate for each submode from the FRA report are presented below, along with percentages suggested for use in design of the Transportation Center. The suggested design percentages are based on observations at the present bus terminals, with the constraint that they be within the limits suggested by the FRA report.

TABLE 6  
1990 SUBMODE SPLIT

<u>Submode</u>	<u>Commuter Bus</u>		<u>Intercity Bus</u>
	<u>Fair</u>	<u>Inclement</u>	<u>All Weather</u>
Walk	80%	72%	10%
Subway	12	15	35
Local Bus	6	10	5
Taxi	0	1	10
Kiss & Ride	0	0	20
Park & Ride	0	0	8
Intra-terminal	<u>2</u>	<u>2</u>	<u>12</u>
	100%	100%	100%

#### Bus Volumes

Table 7 shows estimated daily and peak period design-day bus movements for 1990.

Commuter bus daily totals are obtained by multiplying 1975 scheduled buses by 1.66, which represents the change in ridership from current estimated levels to 1990 design-day levels.

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\*DC/STV, Inc., Northeast Corridor High Speed Rail Passenger Service Improvement Project, Task 7A - Terminals, for the Federal Railway Administration, May 1975.

Peak-period commuter bus movements are based on passenger volumes in Table 5 and calculated by assuming an average peak-period ridership of 35 passengers per bus in the peak flow direction, and 20 passengers per bus in the off-peak flow direction.

For intercity buses, movements were calculated from design-day ridership in Table 5, on the basis of 30 passengers per bus during all periods of the day.

TABLE 7

1990 DESIGN-DAY BUS ARRIVALS AND DEPARTURES

	Commuter *		Intercity **	
	<u>Arrivals</u>	<u>Departures</u>	<u>Arrivals</u>	<u>Departures</u>
Design Day	661	661	242	242
A.M. Peak Hour	175	44	24	24
A.M. Peak 1/2 Hour	100	26	16	16
A.M. Peak 15 Minutes	60	18	9	9
P.M. Peak Hour	44	175	36	36
P.M. Peak 1/2 Hour	26	100	24	24
P.M. Peak 15 Minutes	18	60	13	13

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\* Design Day Buses from current weekday totals multiplied by ridership growth factor of 1.66. Peak Period Buses from Passenger Volumes @ 35 pax/bus. Off-Peak Buses from Passenger Volumes @ 20 pax/Bus

\*\* All Intercity Bus movements figured from passenger volumes @ 30 pax/Bus.







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